

MARCY (H. O.)

*Compliments of the Author.*

I. FEMORAL AND VENTRAL HERNIA IN WOMAN.

II. THE KANGAROO SUTURE.

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## II. THE KANGAROO SUTURE.

BY

HENRY O. MARCY, A.M., M.D., LL.D.,

OF BOSTON, U. S. A.,

PRESIDENT OF THE AMERICAN MEDICAL ASSOCIATION; SURGEON TO THE HOSPITAL FOR WOMEN,  
CAMBRIDGE, ETC.

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## FEMORAL AND VENTRAL HERNIA IN WOMAN.

By HENRY O. MARCY, M.D.,

BOSTON.

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THE student who will take the trouble to review the various methods which have been put into practice in one generation only to fall into disuse and be forgotten in a subsequent one, will note that within the last half-century the pendulum of opinion swung as far away from the attempt at surgical procedures for the cure of hernia as at any time, perhaps, since the days of Celsus. Even now, when the modern surgeon invades every cavity of the human body with a seeming impunity which borders almost upon recklessness, the cure of certain forms of hernia is acknowledged as the opprobrium of our art, and if ever to be undertaken, only in cases of the rarest exception.

In contrast with this, the following quotation from Arnaud<sup>1</sup> would do justice to the most enthusiastic surgical disciple of today: "It is only since the beginning of the present age that cures truly singular have been performed. The knowledge which has been acquired in anatomy, and the discovery of new kinds of ruptures, have enabled skilful surgeons to correct the methods prescribed by former authors, and to invent new ones, according to the exigency of the case. This superiority in the knowledge of anatomy has taught them methodically to treat ruptures accompanied with putrefaction, which used, within these twenty years, to be abandoned to the mere care of Nature. It has given them the boldness to cut away with success, two, four, or even six feet of the mortified intestine, in order to secure

<sup>1</sup> George Arnaud, "Treatise on Hernia," London, 1748.



the rest from gangrene. By this exact knowledge in anatomy they are cured of their prejudice concerning the epigastric artery in inguinal ruptures. They have learnt to preserve the spermatic vessels in crural ruptures of men; nor is there any rupture, however complicated with adhesions, which they do not surmount. To open the intestine in case of necessity, and to search out, in the recesses of the abdomen, the most remote strangulations, are achievements only to be found in the most modern surgery, which is not without expedients in the most desperate cases. To repress any doubt of this truth, nothing is necessary but to look into the memoirs of the Academy of Sciences, at Paris, where the most surprising cures of this kind will be found; such as the people looked upon to be supernatural, until they were insensibly familiarized to the miracles of art. He who reads Mr. Garengot's *Treatise of Operations*, will see the dexterity requisite in the different methods necessary for the cure of these diseases, and find all the means of success laid down according to the greatest masters which our nation has seen in the last or the present age."

The opportunity is not afforded us, at this time, however interesting and profitable it might be, of wandering amid the paths of history, but closely associated with Arnaud were Le Dran, Heister, Percival Pott, and many others, under whose leadership operations for the cure of hernia were freely undertaken and followed with the most excellent results. Early in the present century, Camper, Cloquet, Cooper, Gimbernat, and Scarpa, practically exhausted the subject of the normal and pathological anatomy of hernia. The perfection of the operation for the cure of hernia was, however, reserved entirely for modern surgery.

The history of the anatomical researches of the structures involved in femoral hernia and their relations constitutes one of the most interesting chapters in anatomy. The importance of a correct anatomical knowledge was recognized by Albinus and Heister. The sheath of the femoral vessels was, at this time, a subject of marked discussion, and was then called the cellular substance of Ruysch, who first described it. This tissue, however, Heister considered as one of the two layers of

membrane of which the peritoneum was commonly supposed to consist. Gimbernat made careful dissections, and clearly and accurately described them. He pointed out that a lamina of the fascia iliaca passes over the pectineus muscle and is attached to the crest of the os pubis, and there unites with the ligamentous expansion which bears his name and terminates upon the same crest. "By this union is formed a species of ligament which passes along the crest immediately above the insertion of the superior extremity of the pectineus muscle; from this division of the crural arch, an aponeurotic sheath arises at the top of the thigh, beginning at the crural arch itself, close to the body of the pubis, so that the expansion which has been described, and which is sent from the internal edge of the arch, passing behind the iliac vessels, forms the posterior wall of the sheath, whilst the anterior wall is formed by the external edge of the fascia lata."

Sir Astley Cooper added materially to this knowledge by his investigations of the transversalis fascia, and he demonstrated that a process of it, in forming the femoral sheath, constituting its front wall, passes immediately behind Poupart's ligament, and forms a connection with its thin posterior edge. Mr. John Gay,<sup>1</sup> who made an exhaustive study of the anatomical relations in femoral hernia by the careful examination of over seventy subjects, writes that—"according to my examinations of this structure, both before and subsequent to maceration of the parts, it appears to be formed in the following manner: the *inner* portion of the fascia transversalis being extended behind the crural arch downward into the thigh, in front of the femoral vessels, constitutes the front wall of this sheath; whilst the lateral expansion of this process, each taking converse direction in relation to each other, constitutes the iliac and pubic walls. These unite *behind* the vessels and in this manner complete the sheath. Thus, in the part of the thigh under consideration, the sheath is wholly formed by an expansion of the transversalis fascia."

It might seem almost like a refinement of anatomical differentiation to spend this vast amount of time in special research

<sup>1</sup> On Femoral Rupture, London, 1848.



upon seemingly unimportant tissues, which hold the relationship only to the vessels and the parts which surround them, but these master anatomists were actuated by a far higher purpose than that of hair-splitting differences, since they sought to demonstrate Nature's defective construction which makes femoral hernia a possibility. For our present purpose, in offering a contribution upon this subject to a Society who are all learned anatomists, it will be sufficient to point out that the natural provision for an opening to permit the passage of the femoral vessels must be sufficiently large to provide for a considerable variation in the amount of blood passing through them, and that the loose-meshed connective-tissue sheath is a wise provision for their support. I pass over purposely the further consideration of the anatomical relationship of the other structures involved in femoral hernia, since this well-worked field offers little that is new or important. It is well, however, to emphasize the relation of the obturator artery to the femoral ring, since once in every three or four individuals it arises by a common trunk with the epigastric artery. This vessel occasionally curves along the margin of Gimbernat's ligament, as it passes to the obturator foramen, and when this occurs it is very likely to be divided in the operation for strangulated femoral hernia.

It is easily understood, from consideration of the anatomy of the parts, that the femoral ring, although reinforced and protected in such a marvelous manner, must be a weak point in the abdominal wall. By congenital defect, laxity of tissue, or by long-continued pressure, the peritoneal covering over the ring becomes pouched, and a lodgment of the abdominal contents serves as a wedge to force open the canal. The greater size of the canal in women, together with the firmer character of the inguinal ring, renders this variety of hernia more common in the female.

When the hernial contents are strangulated the stricture may be found in the neck of the sac. This, however, is rare. More commonly it is at the juncture of the process of the fascia lata with the edge of Gimbernat's ligament, or at the margin of the saphenous opening.



OPERATION.—When the operation for a strangulated femoral hernia is under consideration, it is well to remember that pathological changes have greatly modified the normal anatomical relationship of the parts. The tissues covering the tumor, if of long standing, are often blended into a single thin-walled sac. The division of the constriction is usually best made by carrying the probe-pointed knife upon the finger carefully through it, and cutting obliquely inward and upward toward the umbilicus. It is often surprising to note that the division of a few sharp-edged tense fibres is quite sufficient for the relief of the constriction. More commonly there is about a half-inch space between the ring and the epigastric artery; should this vessel be divided, however, it is not attended with very serious consequences. As a rule, there can be no doubt but that, in femoral hernia, the sac should be opened and examined. This is even more important than in the other varieties of hernia, since the sharp-edged narrow constriction often causes a fatal intestinal lesion in less than a single day.

Having safely returned the abdominal contents, the subsequent procedures for the purpose of cure is the subject to which I wish especially to call your attention, and it is the reason for the presentation of this paper.

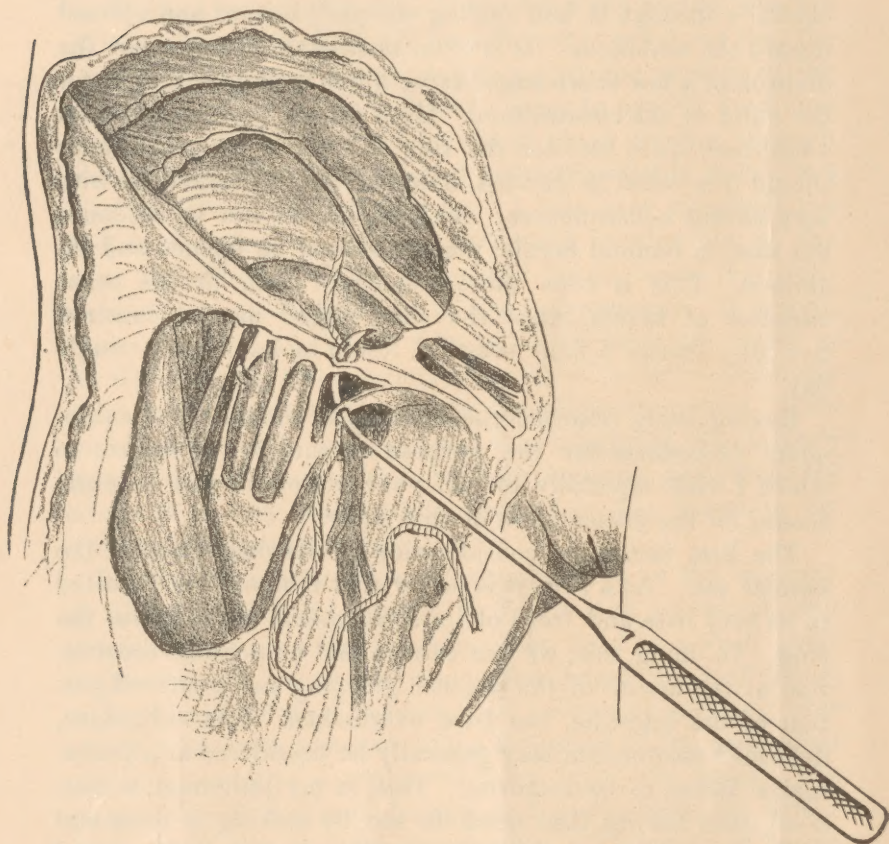
The first factor for consideration is the disposition of the hernial sac. As a rule, it is better that it should be dissected to its very base and freed of its attachments quite within the ring. In doing this, we are certain that no possible constriction at the mouth of the sac, still grasping an unreduced portion of the intestine, has been overlooked. The redundant, deformed peritoneum may generally be considered as a pathological factor to be removed. This, in my judgment, is best done, after having thus freed the sac, by making it tense and ligating or, better, suturing it evenly across at its base and resecting.

Mr. Macewen, in his able article,<sup>1</sup> reports a number of cases of femoral hernia treated satisfactorily by the buttressing of the parts with the intra-folded sac, stitched within the ring.

<sup>1</sup> British Med. Journal, December 10, 1887

Dr. H. W. Cushing,<sup>1</sup> of Boston, gives a detailed account, with illustrations, teaching the mode of applying the sutures, where he adopted the Macewen method in the cure of a case of femoral hernia in a boy, and, after the return of the sac folded to make a pad, he closed the ring with silk sutures. The cure was complete.

FIG. 1.



Femoral hernia. The first stitch taken parallel to the vein for closing the crural ring.

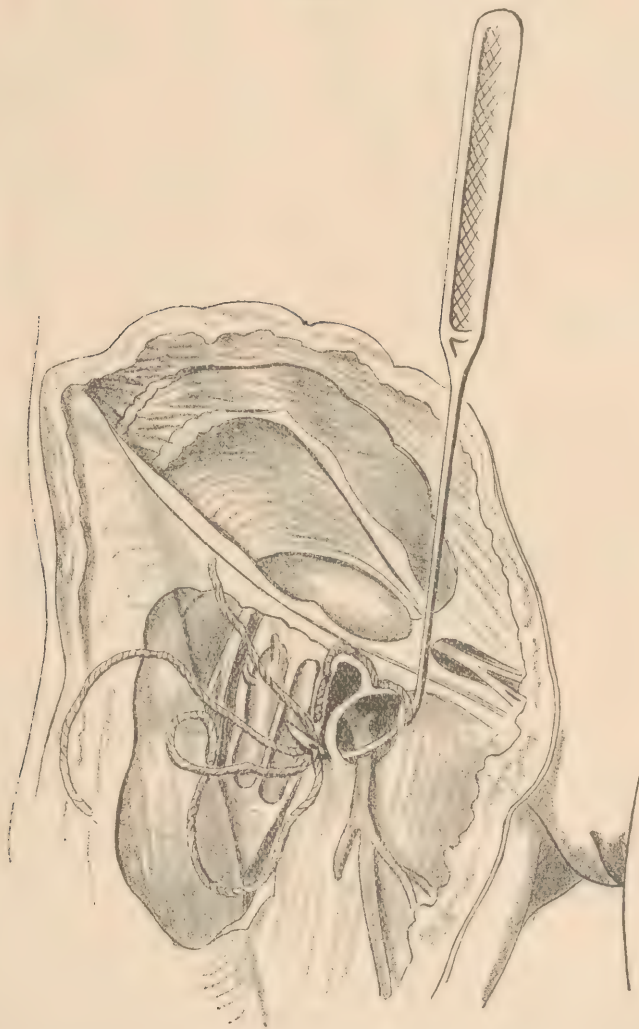
*Femoral canal.* The next step in the operation is the closure of the femoral canal. After having returned the sutured base of the peritoneum within the ring, protecting the femoral vessels with the finger, by pressing them in their sheath gently outward, introduce a curved needle, with eye

<sup>1</sup> Boston Med. and Surg. Journ., December 6, 1888.



near the point, threaded with tendon, from below through the thick pubic portion of the fascia lata forming the external lower border of the ring upward through Poupart's ligament,

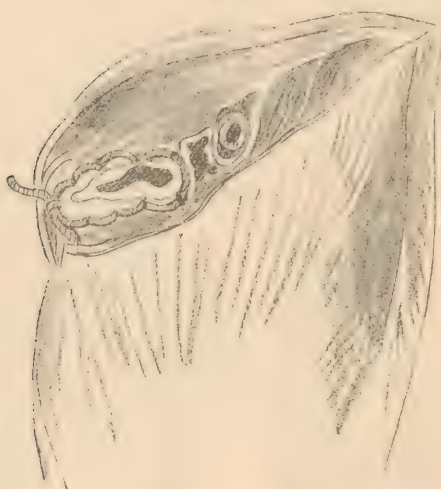
FIG. 2.



Femoral hernia, showing a third stitch taken for closing of the canal by the use of the double continuous tendon suture. The stitches are represented as loosely drawn in order to show the method of suturing. The needle is passed through the firm pubic fascia and the outer border of the saphenous opening, and when drawn closely will fold the latter inwards.

as far outward as may be judged necessary to produce the proper constriction of the parts upon the vessels; unthread the needle, rethread with the opposite end of the suture and withdraw it. This makes a constricting loop, closing the outer border of the enlarged femoral canal upon the sheath of the vessels. A second continuous stitch is taken through the same tissues, parallel to the first, from one-third to one-fourth of an inch nearer to the median line; the third continuous stitch is introduced into the portion of the fascia lata, external and parallel to the saphenous vein, in the same manner as the first, and is carried upward to include Gimbernat's ligament and such portions of tendinous structures as may have been divided. If the operation has been undertaken for strangula-

FIG. 3.



Shows the internal ring closed by the double continuous tendon suture. Stitches loose to show method of suturing.

tion, three stitches are generally sufficient, but a fourth, or as many more may be taken as are required to close evenly and firmly the inner portion of the ring. By suturing in this manner the margins of the ring are firmly closed, and the thick reinforced edge of the fascia lata is joined to the borders of Poupart's ligament.



The lower part of the canal is obliquely elongated and reformed by drawing inward the weakened dilated upper and outer border of the saphenous ring and attaching it to the firm pubic fascia. The folding over of the fascia in this way carries the saphenous opening quite a little to the inner side of its former site, while the femoral vessels are undisturbed in their sheath. The superficial tissues and skin are closely held in approximation by buried tendon sutures. The wound is sealed with iodoform collodion without drainage. It is almost needless to remark that the strictest aseptic care is maintained during the entire operation, in which irrigation with a weak sublimate solution serves an important part.

There is but one rule, and it cannot be too emphatically enforced: the *aseptic* suture must be *aseptically* applied in *aseptic*

FIG. 4.



Needle used in the application of the deep double continuous suture.

structures, and the wound must be maintained *aseptic*. The failure of either of the above-mentioned factors not alone endangers the result, but may be followed by the most serious consequences. Modern surgery demands of the operator every safeguard to insure an aseptic wound, but he who uses buried animal sutures must take, if possible, even greater precautions, since infection carried into a wound thus firmly closed is, for obvious reasons, attended with much greater danger than in a wound united by interrupted sutures which, at the end of a few days, are to be removed, and where drainage is relied upon to permit the escape of infective or foreign material. It is, in part, on account of defective technique, the use of drainage, and the too often septic wound, that failure to effect a cure after hernial operations so generally occurs.

In Dr. William T. Bull's<sup>1</sup> report of sixty-nine operations for the cure of hernia, thirty-seven, over fifty per cent., were followed by suppuration. He writes: "I am sure there are more cases of prolonged suppuration and slow-healing sinuses, due to local sepsis, than in other wounds."

In the present state of our knowledge, notwithstanding the utmost care and precaution, no operator can be absolutely certain that any given wound is not infected, and that the processes of repair will go on without disturbance. However, under the modern methods of surgical operations and the treatment of wounds thus made, the risk of infection is so minimized that as a matter of practice, it is not taken into account. Indeed, each year's experience adds to my own assurance that in every wound, deliberately made in uninfected tissue, the divided structures should, as far as possible, be closed, layer by layer, with buried animal sutures, including even the superficial tissues and skin itself, which latter is to be dried and immediately sealed with germ-proof collodion. In all such wounds the drainage-tube is far worse than useless—a positive source of danger—and when used necessitates cumbersome, expensive, antiseptic dressings, involving unceasing care on the part of both nurse and surgeon. When the location of the wound is in the region of the groin, as in hernia, no matter how applied, these dressings often fail to protect the wound, and sepsis follows.

Under the most favorable circumstances with an aseptic wound, those portions of divided structures which are held apart by the drainage-tube must unite by the comparatively slow process of granulation. I hold in the highest esteem Dr. Bull's ability as a surgeon, and feel, in common with many others, a deep obligation for his judicial article, giving a careful analysis of the large number of cases of hernia upon which he has operated. I understand and appreciate the difficulties which he has had to meet and encounter in operating in a general hospital, including a large class of neglected strangulated herniæ, conditions where the integrity of the parts were often seriously compromised by unwarranted delay and inju-

<sup>1</sup> Transactions New York Medical Association, 1889.



dicious efforts at reduction. I am also well aware of the care exercised under his direction in the subsequent treatment of his patients; however, since he is quoted as an authority, showing that with all our vaunted measures of modern wound-treatment, a majority of hernial operations are in a measure confessed failures, it becomes us seriously to criticise and inquire if this is the best result that can be expected in this department of surgery. I believe we are warranted in emphatically declaring in the negative.

The all-important factor for cure in inguinal hernia, after the removal of the sac, in a manner to leave the reformed peritoneum smooth, is the restoration of the obliquity of the closed inguinal canal. This can be effected only by buried sutures, and it is easy of demonstration that along the line of an *aseptic* animal suture, introduced aseptically into any healthy structure, there follows an abundant proliferation of new connective-tissue cells, which replace in a large measure the absorbed sutures and greatly reinforce the enclosed structures. In this lies one of the chief advantages of the tendon suture over silk, an importance never to be forgotten in the ligation of a large vessel and in the application of buried sutures, perhaps nowhere of equal importance as in the reformation of the obliquity of the canal in inguinal, and its closure in femoral hernia. I am certain that carefully made wounds in healthy tissues, even when of considerable magnitude, as in the amputation of a breast, should be restored as above directed. Repair goes on by primary union as in a subcutaneous wound, with not more than 2 or 3 per cent. of failures, while 5 per cent. should be ample for operative wounds in general hospital practice.

I have been led to this seeming digression, since a method has been devised and widely adopted for obviating the dangers and lessening the ill effects resulting from suppurating wounds, which are recognized as so likely to occur in operations for the cure of hernia. This is the open wound method so ably advocated by the distinguished surgeon, Dr. Charles McBurney, of New York, and called after his name. This method, however, was advocated and widely practised more than a century ago by Petit, Le Dran, Arnaud, and their followers, and when we

consider the treatment of wounds at that time, with far better reasons than to-day. However, the great percentage of deaths from peritonitis and sepsis caused the abandonment of these surgical measures in large degree, until the knowledge of the rôle of bacteria in wounds led to the antiseptic dressings and the modern methods of treatment.

The essential factors urged by Dr. McBurney are—first, and I think most wisely, a free dissection of the parts, the ligation of the peritoneal sac at its very base, and its removal; second, in order to prevent its closure, the wound is deliberately filled to its very base with antiseptic dressings. Repair goes on slowly until the parts are finally closed by a firm, strong cicatrix. This method is effective in preventing suppuration and germ-contamination, but the wound heals slowly and often leaves a tender and painful cicatrix. I am quite sure that cure is more likely to remain permanent after this method of treatment in femoral than in inguinal hernia. Under recent date Dr. McBurney writes me that “in femoral hernia he has never known a single failure when he had treated the wound by his open method.” Since I have had no personal experience with the method advocated by Dr. McBurney, and my criticisms are based upon general principles, I quote from Dr. Bull’s paper, as he has had considerable experience in operating for the cure of hernia by this method: “I am not convinced that it is correct in principle, and I believe, when time has permitted its results to be tested, that it will be found defective in practice. It is certainly a perversion of our knowledge of the phenomena of repair to assume that the granulative cicatrix is stronger than that of primary union. There is no other region of the body where surgeons of experience would act in accordance with this idea.”

I began to use the buried animal suture, in operating for the cure of hernia, in 1871, and since that time have for the most part used it in the closure of all operative wounds; and in all my operations for the cure of femoral hernia, where the integrity of the intestine has not been involved, I have never observed a subsequent symptom indicating danger, and, so far as I have been able to learn, there has not been a single recurrence. Pain and discomfort are practically wanting, and even edema



of the tissues does not ensue. After a few days in bed the patient is allowed to sit up. In some instances I have permitted the use of the chair the second day without any apparent harm.

It does not seem necessary to make a special plea in the advocacy of operative measures for the cure of femoral hernia. This variety of hernia is admitted by all, as one of the most troublesome and difficult to retain by instrumental supports. When any portion of the abdominal contents escape through the ring, its reduction is attended with much greater difficulty than in the other varieties, owing to the firm, tense, inelastic character of the constriction.

When not reduced, the danger to the parts constricted is in like ratio increased for the same reason. If it can be demonstrated that femoral hernia is curable, then the advisability of the operation should be taken into consideration, and if it can be proved that the cure remains permanent, it adds much to the argument in favor of operative measures; but when it is demonstrated that, under proper precautions, based upon an accurate anatomical knowledge of the structures involved, the operation is not severe, does not cause long detention from active duties, does away with the punishment inflicted by the lifelong wearing of a truss, and is almost without danger, there remains no reason why all the sufferers from femoral hernia should not profit by surgical measures and demand to be restored to the ranks of active service.

The operation for the radical cure is obviously much more simple where the conditions pertaining to incarceration or strangulation are absent. The normal anatomical relationship of the parts is usually not much changed. The tumor is generally small, the omentum or intestine easily returned, and the sac may be so thin and small as to become an unimportant factor. The danger of infecting the general peritoneal cavity scarcely exists even in the hands of an inexperienced operator. The wound does not usually require to be made nearly as large as where operation is undertaken for a strangulated hernia, yet it is well to err on the side of a free dissection. The operator must be sure of the anatomical relations of the parts. The femoral vessels must remain uninjured in their sheath.

The greater danger attends the introduction of the first stitch, since this closes the canal on the side toward the vessels, and a puncture of the great femoral vein with the needle might result in the most serious consequences. However, this warning is of little moment to the experienced surgeon, since the sheath of the great femoral vessels is the first anatomical landmark to be located with exactitude.

### UMBILICAL AND VENTRAL HERNIA.

My purpose is by no means to write exhaustively upon the interesting subject of the cure of umbilical and ventral hernia in the female. Every surgeon is brought face to face with the most serious dangers to life in the treatment of old strangulated umbilical hernia, and it is a common experience to bemoan a life lost by the delay and neglect attendant upon the effort at relief. Until within a very recent period few complications in surgery have been held in greater fear, since the infective peritonitis, which often followed operative measures, ended so fatally.

I am constrained to believe, from my own experience, that by far the larger number of cases of strangulated umbilical hernia are still improperly treated owing to this dominating fear. As in the other varieties of hernia, prolonged and repeated attempts at reduction, with the application of far too great and oftentimes illy adapted force, are made; and even after failure by these measures, inexcusable delay frequently follows before the physician, the friends, and patient are educated up to the undertaking of what they consider the *dernier ressort*, surgical interference—and which, indeed, if relied upon at this period of the disease, is associated with extreme danger, a danger to be emphasized as dependent not upon the surgical measures undertaken for the relief, but upon the condition of the incarcerated abdominal organs, which have been subjected to the criminal manipulation and neglect of an incompetent adviser.

The number of lives lost annually by want of proper treatment is far greater than is generally supposed, and it is hardly possible to emphasize too strongly the condemnation of the

Micawber-like policy, which is the too common practice in dealing with this serious lesion.

There is but one surgical rule to be adopted in the treatment of strangulated umbilical hernia—an immediate and careful attempt at reduction should be made under ether, and this failing, the constriction must be at once divided. This generally necessitates the opening of the sac, which is important, even in recent cases, in order that the surgeon may determine the condition of the constricted contents. When it is found that these admit of a safe return into the abdominal cavity, the problem then confronting the surgeon is, Shall an effort be made to effect a permanent cure of the disability?

I think the consensus of surgical opinion is in favor of an affirmative reply; and that the large, old, deformed sac should be resected and removed as a pathological factor. Having done this, the more common method advocated is to join the pillars of the ring with deep interrupted sutures, preferably of wire, the application of an antiseptic dressing, and a supporting abdominal bandage. I wish especially to invite your attention to women with thick, heavy abdomens, suffering from irreducible or uncontrollable umbilical hernia. The hernial contents often become, at an early stage of the disease, adherent and irreducible. It is at first for the most part omentum, and later is associated with a more or less easily replaced loop of intestine. This in time may become adherent, and the patient is rendered, in a degree at least, an invalid, subject to colic pains with the whole catalogue of intestinal disturbances. These permanent tumors are oftentimes of very considerable size, and at the best are imperfectly supported by trusses especially designed for this purpose. The patient is limited in physical exertion, is constantly more or less a sufferer, and ever in danger of intestinal obstruction.

What are we to do in the case of this very considerable class of invalids? is the question which is constantly presenting itself to the surgeon for solution. The early surgical writers, from Celsus down to the French masters of the last generation, advocated and practised a variety of operations for the cure of umbilical hernia. The chief difference of opinion was in



reference to the disposition of the sac: should it be ligated unopened?

We now see clearly the reason why in the larger experience it was found advantageous to ligate the sac at its base, unopened, since this was constricted sufficiently to produce necrosis, and the resulting wound was almost necessarily an infected one, healing only slowly as a suppurating wound. Beginning with the present century, operative measures for the cure of hernia were almost absolutely abandoned, and the first case of which I find any record in America, where the operation was deliberately undertaken for the cure of an old, large, umbilical hernia, followed by recovery, was that published by Dr. H. R. Storer,<sup>1</sup> 1866, now of Newport, R. I. I well remember the storm of criticism evoked in Boston at the presumption of doing an operation so dangerous to life, which the verdict of surgical opinion had pronounced as unwarranted, an opinion which I regret to believe still generally prevails, and which a prominent physician of Boston, within a few days, in speaking of Dr. Storer's operation, characterized as foolhardy and unwarranted.

I cannot question but that the opinion of a majority of the members of this Association, accustomed as you are in your daily experience to laparatomies undertaken for a variety of purposes, will consider an operation attempted for the cure of this troublesome affection far more favorably than the general surgeon, or the rank and file of the profession.

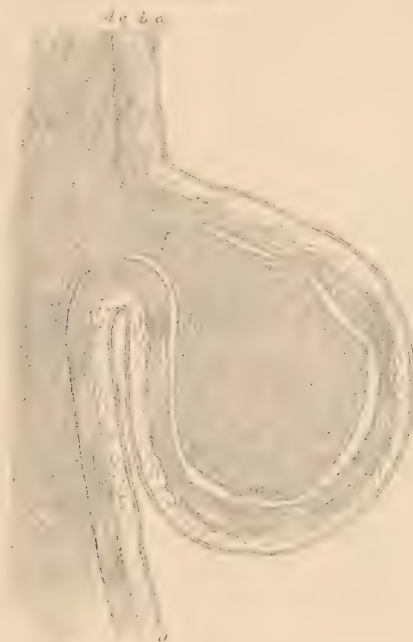
All will agree that the class of sufferers under consideration are seriously disabled, and ever at the risk of a possible danger to life. The question at issue is to determine if cure is possible, and if the measures proposed for this purpose are of a character that warrants their advisement and adoption. To the questions thus presented, I think the evidence is sufficiently ample to give an affirmative answer. That cure is effected by removal of the sac and closure of the opening in the abdominal wall, few can question, and that the cure generally remains permanent there is abundant proof. The danger of the operation has been considered sufficiently great to regard the risk

<sup>1</sup> New York Medical Record, 1866-67, pp. 73-76.

as unwarrantable, and this is the factor of the problem that needs most careful elucidation.

It is easy to comprehend why laparotomy, two decades ago, was undertaken with fear and trembling, when a large proportion, if not the majority of the patients operated upon, died from an infective peritonitis. There are few of us who do not mark the present contrast with a feeling akin to wonder and astonishment.

FIG. 5.



Umbilical Hernia. *a, a*. Integument. *b*. Fat. *c*. Abdominal muscles. *d*. Peritoneum. *e, e*. Hernial sac. *f*. Mouth of sac; umbilical ring.

The operation, undertaken for the cure of umbilical hernia, when the contents of the tumor are non-adherent and can be returned, may justly be considered as an exploratory laparotomy, to be done with all the care of the modern aseptic operator. He who is skilled in making and maintaining an aseptic wound has little to fear, since the danger is almost altogether summed up in the one word—infection.

In large, old, irreducible herniæ the problem is less simple.

Adhesions of the omentum are unimportant, although there may be bleeding-points in the separated parts. The omentum itself is not seldom so altered at the point of constriction about the ring as to be separated with difficulty, and so deformed as to make its return within the abdominal cavity ill-advised. It is not, however, a serious complication to remove considerable masses of omentum and to control the resultant hemorrhage. Sew through the base of the unconstricted part with one or even two lines of *continuous* sutures. It must be remembered that necrosis, by a too firm compression, such as too commonly follows from ligation, is to be avoided. Compression evenly applied, although quite moderate, is sufficient to control any ordinary hemorrhage. When loops of intestine are adherent, much care is demanded in separation, and oftentimes it is wiser to resect a portion of the sac at the point of adhesion. A few light running stitches are sufficient to intra-fold this, a precaution to be recommended before returning the intestinal loop into the abdomen.

In umbilical hernia the sac differs essentially from that in the other forms of hernia, in that the whole peritoneal pouch is generally closely united to a thinned-out cutaneous investment. This skin covering the sac is of no value in the restoration of the parts; its vascularization is greatly diminished, and when, under favorable circumstances, a portion of it is retained for a special reinforcement to the parts, its vitalization is so defective as to break down easily and complicate the repair processes. It is therefore better, as a rule, to resect the peritoneal sac and its external envelope quite to the margin of the ring.

The reinforced bands of connective tissue which surround and fortify the ring are subject to considerable modifications of treatment, dependent upon their disposition. When the opening is small, two or three deep stitches may be sufficient to unite the edges of the ring and hold them in firm apposition. If the opening of the ring is considerably larger and the edge of the ring sharp and firm, under favorable conditions I do not hesitate to recommend following down the peritoneal folds of the sac and separating them quite within the edge of the ring, and joining the peritoneum with a line of continuous



tendon sutures, before resecting as advised in the treatment of the sac in other varieties of hernia. This has its advantage, in that the abdominal cavity is thus shut off from extraneous contact, and the subsequent steps of the operation can be conducted, if desired, under the protection of irrigation. Moreover, it refreshes the edge of the ring, which favors a better reunion of the parts. The edges of the ring are often advantageously split laterally, which permits the union of the parts by a double row of buried continuous sutures.



Fig. 6.—Peritoneum united after resection of the sac. The abdominal wall divided laterally for coaptation. *a*. Skin. *b*. Fat. *c*. Abdominal muscles. *d*. Peritoneum. *e*. Line of resected peritoneum. *f*. Outline of rounded sac. *g, g* Lateral division of abdominal wall.

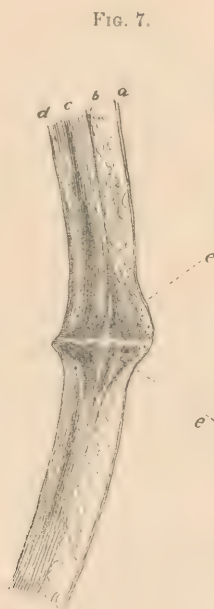


Fig. 7.—Diagram of the abdominal wall after union of the parts. *a*. Skin. *b*. Fat. *c*. Abdominal muscles. *d*. Peritoneum. *e, e*. Line of union of abdominal wall after coaptation.

Again, it is sometimes wiser to resect the ring altogether and close the walls of the abdomen as in an ordinary laparotomy.

I do not hesitate to advise the use of the deep, double, *continuous* tendon suture, applied in the same manner as recommended in femoral hernia, only the needle and tendon should be of a larger size and the sutures taken at a considerable distance away from each side of the margins of the opening, in order to coapt and evert the enclosed portions. By the introduction of the sutures in this manner, as also in the splitting of the edges of the ring laterally, the object gained is the **thickening and reinforcement of the parts.**

The superficial tissues are to be joined by a line of light running sutures, as also the skin itself, the needle penetrating from side to side the deeper layer only, and the dressing is completed by the application of iodoform collodion, reinforced by a few fibres of cotton. Since the patient generally has heavy abdominal walls, it is well to apply a rather firm, wide bandage. Almost the only subsequent care necessary is to maintain the patient at rest in a position where the recti muscles are not called into use.

I have had occasion to operate upon a very considerable variety of umbilical herniæ where I have put in practice the measures above recommended. Although, in a number of instances, I have resected considerable portions of omentum, I have never seen any ill results therefrom, and in no case where the integrity of the intestine was not involved has the patient even approached the danger-line. So far as I have been enabled to follow my cases, cure has not alone been speedily obtained, but it has remained permanent.

Dr. Championnière, of Paris,<sup>1</sup> writes: "I believe the urgency for the cure of umbilical hernia to be very great, and I do not hesitate to advise every young woman, whether the hernia be large or small, to be operated upon, since she is doomed her life long to a painful and dangerous infirmity. The operation now is excellent, and the danger is not materially greater than in other varieties."

He advises the dissection of the sac to its very base, suturing across and removing it. He closes the walls with interrupted

<sup>1</sup> "Etude sur la Cure radicale de la Hernie non-étranglée," Journ. de Méd. et Chir., 1888.

catgut sutures, applied in layers, outside of which are generally stay sutures. "The ideal of hernial surgery is, that operations should be done before the tumor becomes very large. We should then avoid the descent of the large intestine, the great size of the tumor, and the complications of the general health." This author is assured that if suppuration even in slight degree ensues, the chances of relapse are greatly increased.

It is now nearly five years since I adopted the method of uniting the abdominal walls by means of buried animal sutures in all cases of laparotomy, and in considerably more than one hundred cases which I have thus united, so far as I have been able to follow them, there has been but one case of ventral hernia. In this case I performed hysterectomy for the removal of a large fibroid tumor, and the abdominal walls had been for a long time extremely attenuated. In this manner I cured one case of ventral hernia, where the opening was of considerable length, extending below the umbilicus, and the tumor the size of an adult head.

The various forms of large ventral hernia, other than umbilical, are usually the result of injury to the abdominal wall, more commonly following laparotomy. Some authorities state that ten per cent. of all laparatomies are followed by hernia. I think this is a large estimate, but abdominal surgery undoubtedly has greatly increased this class of sufferers. When the result of injury, the peritoneal sac may be wanting. There is very rarely a firm inelastic ring at the base, and strangulation far less commonly supervenes; but a marked degree of invalidism often results from the difficulty of the retention of the abdominal contents, and operation is advised when the disability is at all marked. The technique is exceedingly simple, consisting of reduction of the hernial contents, resection of the sac, and a firm closure of the abdominal walls as recommended in umbilical hernia.

No chapter in the history of surgery surpasses in interest and profit that of wound treatment in the last two decades. The biological investigations of bacterial growth in its omnipresent energy and potent influence over the human race for good or evil, are still so recent that we are yet unable fully to



appreciate or fairly judge of their importance and value. Truth is ever more marvelous than fiction, and the new world to which we are introduced by means of the modern microscope, although infinitely small in its individual membership, possesses a power infinitely great over the higher organisms from birth until death. So fundamental and far-reaching are these hitherto unknown factors of biological character that they underlie, and in large measure modify, our very existence. Without their potent energies the very life processes must, in a short period, cease upon our planet, dependent as they are upon the never-ending round of the transmutability of material upon which life itself must exist.

By the misdirected force of this invisible power the higher organic life is ever threatened—known to us under the various names by which we call the more common and fatal diseases. Introduced into wounds, these organisms become agents endowed with the highest potency of a death-dealing character. By a better knowledge of our invisible vital surroundings, many of the hitherto inscrutable mysteries, fraught with pain and suffering and the foreshortening of our very existence, are being made clear. The hidden rocks and reefs so fatal, during all the centuries, to the barks of life, launched upon the great ocean of existence, with painstaking care and fidelity are being mapped and charted. This work of the present generation is elevating medicine and surgery from an art into a really great science—God's own law of wonder-working from the infinitely small to the infinitely great—science, the gospel of a new dispensation; knowledge, which has its better definition, as pure and simple Truth.

## THE KANGAROO SUTURE.

By HENRY O. MARCY, M.D.,

BOSTON.

I take pleasure in exhibiting some samples of kangaroo tendons, in the condition in which they are sent to me from Australia. It will be noted that this animal has the tendon of the tail disposed in a bundle of parallel fibres running its entire length. These vary in size, dependent upon the size and species of the animal. As will be observed they are easily separated into even, round, smooth strands of uniform size. Those from the species called the Wallabee are preferable, since the size of the tendons is that more commonly desired for the suturing of wounds. They vary somewhat in length, averaging about twenty inches. I have carefully studied the tendons of every animal which I have thought could furnish the material suitable for sutures. The Indian of the Northwest still uses as thread for domestic purposes the fascia lata of the moose, which is sun-dried and maintained dry until wanted for immediate use. It is not unlike the fascia lata of the buffalo, which from time immemorial until recently furnished an ample supply. It is almost identical with that of the reindeer of Northern Europe, which is still largely in use there as a suture material for domestic and other purposes. Tendons of this character have furnished me in part suture material for surgical purposes for the last ten years. They are, however, very inferior to kangaroo-tendon sutures. The only other animals which I know that have tendons similarly disposed are the common rat, the squirrel, and the opossum.

Dr. C. H. Mastin, of Mobile, has recently sent me specimens from the tail of the opossum, which furnish excellent suture material, but are, unfortunately, only ten or twelve inches in length.

I sent to Australia more than ten years ago for a supply of tendons from the tail of the kangaroo, inferring from the relationship of the species with the squirrel and opossum that the tail of this animal should furnish similar tendons, and, of course, much longer and larger. Only after many and repeated efforts have I within the last two or three years been enabled to furnish a supply much in excess of my own immediate requirements. In earlier years I have paid any price

demanded—even in Australia sixty cents per strand, by the hundred. Now an arrangement has been effected by which an ample supply may be secured for furnishing the entire profession with reliable tendons, prepared under my own personal supervision, at a cost of \$10 per hundred. These are kept by Messrs. Codman & Shurtleff, of Boston, the well-known instrument-makers, from whom they can be obtained, or, if preferred, by sending directly to me. At this price the cost is not much in excess of well-selected and properly prepared catgut, to which it is in every way greatly superior.

The tendons are taken from recently killed animals, are quickly sundried, and kept dry until ready for preparation. They are then soaked until soft in a sublimate solution (1 : 1000), carefully separated, sorted, and quickly dried. They are then immersed in ether for twenty-four hours, although this seems hardly necessary, as they appear to be absolutely free of fat. After this they are chromicized and permanently put up in a solution of carbolic oil (1 : 10), after the Lister formula for the preparation of catgut.

They should be retained in the carbolized oil until required for use, then wrapped in a towel wrung from 1 : 1000 mercuric solution for a few minutes, which makes them supple and easy of application. They do not soften and swell as catgut similarly treated. It must, however, be remembered that every precaution of modern surgery is demanded in placing *aseptic* buried sutures *aseptically* in *aseptic* wounds.

I have experimented in the preparation of suture material in the various ways advocated by a number of authors. I have found none so trustworthy as the chromicized suture permanently kept in carbolized oil. I quite prefer not to use it until it has been prepared for six months, and it appears to improve with age. In the larger sizes in well-vitalized tissues, it can be demonstrated after three or four weeks, and a marked thickening of the tissues is observed along the line of the buried sutures for a considerable period longer.

Catgut has many defects, chief of which is that for days together the intestines of the animals from which it is made must remain in a state of active putrefaction, in order to separate the connective-tissue sheath from the other coats of the bowel. This is then subdivided as required in size, and twisted into a thread—the ordinary catgut or violin-strings of commerce.

The sterilization of this material, to render it safe for sutures and ligatures and not injure its integrity, is by no means easy. It has been shown by many observers, that especially the larger sizes of catgut prepared for surgical use contain bacteria capable, under favorable



circumstances, of reproduction. This is doubtless the most valid reason why catgut as a suture material has fallen into disuse. When its histological elements are investigated it will be seen that its ultimate fibres cross each other diagonally to the long axis of the bowel. This is an admirable disposition to allow of the ever-varying size of the intestine, but is little suitable for the purposes of great strength and inelasticity. The illustration is not overdrawn in the comparison of the attempt to make a strong cord by cutting the finest woven fabric upon the diagonal and twisting it.

So great, however, is the strength of the connective tissue of animals, that catgut when kept dry, as all know, is capable of resisting great strain, as in the high tension of musical instrument strings. But when macerated—a softening process which must take place in the tissues of the body—the catgut unfolds and becomes a soft elastic material. This explains why in the interrupted suture the knot is so untrustworthy. The tendons proper of animals have their fibres uniformly disposed in parallel lines, and as a consequence, when moist, are many times stronger than the same size of catgut.

Under the most favorable circumstances sterilized silk sutures disappear far too slowly and for this reason, if used in any quantity, must generally be applied in a manner to permit of removal. When buried within the tissues they are more generally encapsulated rather than absorbed, and often, even after many months, produce irritation, and are thrown off as a foreign body. A properly prepared aseptic animal suture, buried aseptically in healthy tissues, slowly disappears, and, as histological studies abundantly prove, it is in a large measure replaced by connective-tissue cells, making a band of living constricting or supporting structure surrounding the included part. This will be seen to be of the highest importance in the ligaturing of large vessels, and of almost equal value in the supporting of many of the structures coaptated in wounds, as, for example, in hernia, repair of the perineum, etc.

I am certain that one of the greatest advances of modern surgery is found in the immediate coaptation of all well-vitalized aseptic wounds, hermetically sealed, without drainage. For this purpose the tendon suture is the ideal material, and I hazard very little in predicting that, at an early date, the clumsy, bungling method of closing wounds with interrupted sutures, at the best liable to infection and subsequent danger, will be relegated to history, and the tendon suture will become an indispensable factor in wound treatment.









